

Title: Biological Safety Cabinets Procedure

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Issuing Authority: VP, Facilities and Construction Management

Responsible Officer: Director Environmental Health and Safety

### **PURPOSE OF THE PROCEDURE**

The Biological Safety Cabinet (BSC) program was developed to comply with OSHA regulations and guidance from the Centers of Disease Control and Prevention (CDC) and National Institutes of Health to ensure the proper operation of Biosafety Cabinets (BSCs).

### **SCOPE OF THIS PROCEDURE**

To outline procedures for biological safety cabinet usage in order to minimize employee exposure to biohazardous materials.

### **WHO NEEDS TO KNOW THIS PROCEDURE**

All New York University Academic and Research Facilities.

### **PROCEDURES FOR IMPLEMENTATION**

#### **Responsibilities:**

New York University (NYU) strives for excellence in its biosafety program. For this procedure compliance is achieved through the following structure:

#### **Department of Environmental Health and Safety**

The Department of Environmental Health and Safety (EHS) manages the NYU Biosafety Program. EHS will coordinate with a certifying company to test and maintain BSC's in accordance with requirements. It will also ensure that annual certifications for all BSC are conducted and the records are kept on file. EHS will annually evaluate the biosafety cabinet program. EHS provides biosafety training for labs using biological materials.

#### **Directors or Department Chairs**

Directors are responsible for enforcing the procedure. The Directors will periodically review and monitor the effectiveness of the procedure. Allocate the resources necessary to perform maintenance and calibrations on BSC. Will function to resolve any technical or calibration issues. Ensure calibrations are completed annually by the assigned vendor.

#### **Department Manager and Supervisors**

Supervisors and/or Principle Investigators must ensure that students and employees work with the BSC in the appropriate manner. They must also train new students and employees on how to work in the BSC. If the BSC is not currently certified the lab must contact Environmental Health & Safety (EHS) immediately. The lab must notify EHS whenever the BSC is moved or a new one purchased.

### Maintenance and Housekeeping Personnel

EHS has a certified contractor who will annually inspect and certify all BSC's. BSC's must be cleaned and decontaminated using an active bleach solution if a spill has occurred and then cleaned with 70% alcohol solution. BSC's must be cleaned and decontaminated after every shift. A minimum of annual certification of an operative BSC is required.

### Complaint Response

In the event of equipment failure, the cabinet must not be used. Place a sign on the equipment notifying others not to use the cabinet. If there is a problem with the unit itself, the user shall contact EHS at X81450, who will then contact the NYU certified contractors to expedite repairs. If a problem is suspected with the exhaust system, notify EHS at X81450 immediately. This will enable them to investigate the problem and notify other users of hoods on that system. Any questions regarding biosafety cabinets, biohazardous/potentially infectious materials should be directed to New York University's Environmental Health and Safety at extension X81450.

## PROCEDURE DEFINITIONS

**Biohazardous Materials:** A biohazardous material is defined as an infectious agent, or part thereof, presenting a real or potential risk to the well-being of humans, other animals or plants, either directly through infection or exposure, or indirectly through disruption of the environment.

**Biosafety Cabinet (BSC):** A device enclosed (except for necessary exhaust purposes) on three sides, top, and bottom, designed to draw air inward by means of mechanical ventilation, operated with insertion of only the hands and arms of the user, and in which potentially infectious biological materials are used.

**Biosafety Cabinet Certification:** The yearly or twice annual process of testing the performance and integrity of the biosafety cabinet by NSF certified technician, following National Sanitation Foundation (NSF) 49 standards for biosafety cabinets

# UNIVERSITY PROCEDURE

## RESPONSIBILITIES

### Training:

All laboratory personnel are trained by EHS in laboratory safety that includes training on this procedure. All persons using biological safety cabinets shall be trained by their supervisor prior to operating the cabinets. Manufacturer's instructions shall be strictly adhered to.

### Biosafety Cabinet Certification:

Biosafety cabinets shall be certified when installed, at least annually and when moved from one laboratory to another. A certification card is posted on the cabinet by the vendor performing the certification. Certification shall be coordinated with the New York University Environmental Health & Safety Department.

### Safety Equipment:

1. Personal Protective Equipment
  - a. Specialized clothing, such as long sleeve lab coats, gloves, and eye and face protection, shall be worn by personnel handling biohazardous materials. Personal protective equipment shall be readily available through the department in which the persons are employed.
2. Warning Signs/Labels
  - a. Warning signs shall be placed on doors to laboratories and rooms where experiments involving biohazardous materials/potentially infectious materials are conducted.
  - b. Warning signs shall be placed on refrigerators/freezers where infectious materials are stored and on biosafety cabinets as well.
  - c. BSC certification label shall be affixed to BSC and up to date before laboratory use.

### Biosafety Levels:

The manual, Biosafety in Microbiological and Biomedical Laboratories, published by the Center for Disease Control-National Institute of Health, shall be referred to for detailed procedures and recommendations.

1. Biosafety Level 1 - suitable for work involving agents of no known or of minimal potential hazard to laboratory personnel and the environment. Laboratory personnel shall have specific training in the procedures conducted in the laboratory. No special containment (e.g. a biosafety cabinet) is recommended but not required.
2. Biosafety Level 2 - suitable for work involving moderate potential hazard to laboratory personnel and the environment. Laboratory personnel shall have specific training in handling pathogenic agents and be supervised by competent scientists. Biosafety cabinets (Class I or II) are required when procedures involve a high potential for creating infectious aerosols (e.g., grinding, centrifuging, blending, vigorous shaking, opening pressurized containers, etc.) or when high concentrations or large volumes of infectious agents are used.
3. Biosafety Level 3 - applicable in clinical, diagnostic, teaching, or research facilities where experiments with exotic agents may cause potentially lethal disease as a result of exposure by inhalation. Laboratory personnel shall have specific training in handling pathogenic and potentially lethal agents and be supervised by competent scientists. Class I, II or III biological safety cabinets are required when performing such

experiments.

4. Biosafety Level 4 – Applicable for work with dangerous and exotic agents which pose a high individual risk of life threatening disease. Laboratory staff is required to have extensive training in handling extremely hazardous infectious agents. Class III biological safety cabinets or Class I/II biological safety cabinets used in conjunction with one-piece positive pressure personnel suits ventilated by a live support system are required.

### Types of Biosafety Cabinets:

Biological Safety Cabinets (BSCs) are among the most effective and the most commonly used primary containment devices in laboratories working with biohazardous materials. The three general types available (Class I, II, III) have performance characteristics and applications which are described in this procedure. Refer to “Primary Containment for Biohazards: Selection, Installation and Use of Biological Safety Cabinets”, 3<sup>rd</sup> edition, DHHS/CDC/NIH, Sept. 2007.

Properly maintained Class I and II BSCs, when used in conjunction with good microbiological techniques, provide an effective containment system for safe manipulation of moderate and high-risk microorganisms (Biosafety Level 2 and 3 agents).

#### **Class 1**

The Class I Biological Safety Cabinet is a negative-pressure, ventilated cabinet usually operated with an open front and a minimum face velocity at the work opening of at least 75 linear feet per minute (lfpm). All of the air from the cabinet is exhausted through a HEPA filter either into the laboratory or to the outside. The Class I BSC is designed for general microbiological research with low- and moderate-risk agents, and is useful for containment of mixers, blenders, centrifuges and other equipment. These cabinets are not appropriate for handling research materials that are vulnerable to airborne contamination, since the inward flow of unfiltered air from the laboratory can carry microbial contaminants into the cabinet.

**Note: Class I BSCs are currently being manufactured on a limited basis; many have been replaced by Class II BSCs.**

#### **Class 2**

The Class II Biological Safety Cabinet is designed with inward air flow at a velocity to protect personnel (75-100 lfpm), HEPA-filtered downward vertical laminar airflow for product protection, and HEPA-filtered exhaust air for personnel and environmental protection. Design, construction, and performance standards for Class II BSCs, as well as a list of products that meet these standards, have been developed by and are available from the National Sanitation Foundation International.

Class II BSCs are classified into two types (A and B) based on construction, air flow velocities and patterns, and exhaust systems.

Type A1 cabinets are suitable for microbiological research in the absence of volatile or toxic chemicals and radionuclides, because of the amount of air recirculated within the cabinet and the positive pressurization, without additional engineered containment of its exhaust plenums. A1 cabinets may be exhausted into the laboratory or to the outdoors via a "thimble" connection to the building exhaust system.

Type A2 cabinets operate at a higher face velocity than A1 cabinets and are designed so that any leakage from a contaminated plenum is drawn into the cabinet and released into the environment. When exhausted to the outdoors via a thimble connection, they may be used for work with small quantities of toxic material or radionuclides.

Type B cabinets are hard ducted to an exhaust system and contaminated plenums are under negative

pressure. B1 cabinets recirculate a portion of their exhaust air; B2's exhaust 100% providing the greatest level of protection from toxic materials and radionuclides among the different Class II types.

### **Class 3**

The Class III Biological Safety Cabinet is a totally enclosed, ventilated cabinet of gas-tight construction and offers the highest degree of personnel and environmental protection from infectious aerosols, as well as protection of research materials from microbiological contaminants. Class III cabinets are most suitable for work with hazardous agents that require Biosafety Level 3 or 4 containment.

All operations in the work area of the cabinet are performed through attached arm length rubber gloves or half-suits. The Class III cabinet is operated under negative pressure. Supply air is HEPA-filtered and the cabinet exhaust air is filtered through two HEPA filters in series, or HEPA filtration followed by incineration, before discharge outside of the facility.

All equipment required by the laboratory activity, such as incubators, refrigerators, and centrifuges, must be an integral part of the cabinet system. The Class III cabinet must be connected to a double-doored autoclave and/or chemical dunk tank used to sterilize or disinfect all materials exiting the cabinet, and to allow supplies to enter the cabinet. Several Class III cabinets are therefore typically set up as an interconnected system.

#### ***Applications***

Biosafety Cabinets will be used for work with tissue cultures, particularly non-human primate and human tissue and organ cultures.

Class I or II cabinets must be used for Biosafety Level 2 work with the potential for aerosol generation.

Class II cabinets must be used for all Biosafety Level 3 work involving open manipulation of infectious materials.

### **Installation/Certification**

1. Biosafety Cabinet unit should be installed as far away as possible from supply and exhaust grilles, fans, doors, high traffic areas, fume hoods, and windows that may be opened.
2. The BSC must be certified immediately after installation or movement to a different location.
3. All Biosafety cabinets shall be posted with an active "Certificate of Certification" card on the unit displaying the most recent certification date.
4. Natural gas lines are not to be installed in new BSC's.
5. Biological Safety cabinets shall be recertified at least yearly or as deemed necessary by Environmental Health & Safety based on the hazards involved.
6. All biological safety cabinets must be recertified if relocated or repaired.
7. Installation of UV lights within a BSC is not recommended.
8. Independent electrical circuit systems are required.
9. A proper ceiling height of 12 to 14 inches above the top of the BSC is required.
10. Adequate ventilation, based on manufacturer's specifications, must be provided for ducted BSC's.
11. Storage of items on top of the BSC is prohibited.
12. No modifications to the BSC may be performed unless approved by EHS.

### Biosafety Cabinet Usage Procedures:

1. Keep rear exhaust and front air intake grilles unobstructed so as not to hamper proper airflow into the cabinet.
2. Allow cabinet to run five minutes prior to use.
3. After turning on a Biosafety Cabinet, the working surface should be disinfected with a 70% alcohol solution.
4. Operate the sash at the cabinet manufacturer's design criteria, i.e. 8" or 10".
5. Materials for the experiment should be placed inside the cabinet prior to the start of the experiment. All materials/equipment should be disinfected with 70% ethanol prior to placing in the hood. Overloading of material in the cabinet should be avoided because materials may obstruct optimal airflow.
6. Place all equipment which may produce air turbulence (e.g., centrifuge) near the rear of the hood and stop all other work while this equipment is running.
7. The use of any devices or activity that results in aerosols of potentially infectious materials such as: blenders, cell disrupting, lyophilizers, ampoule opening, ultrasonic disrupters, and grinding equipment, should be performed in a BSC.
8. Vacuum traps with disinfectant and in-line HEPA filters should be used to eliminate contamination to in-house systems. For proper vacuum line set-up, place dual aspirator flask in series with an in-line HEPA filter between the vacuum trap and the source valve. Use thick walled tubing to connect the system to prevent collapse.
9. Internal cabinet air disturbance and heat buildup should be minimized. The use of an open flame is discouraged since it creates turbulence which disrupts the pattern of HEPA-filtered air supplied to the work surface. When deemed absolutely necessary, touch-plate microburners equipped with a pilot light to provide a flame on demand may be used. The burner must be turned off when work is completed. Small electric furnaces are available for decontaminating bacteriological loops and needles and are preferable to an open flame inside the BSC. Disposable sterile loops may also be used.
10. No chemical manipulation is permitted in a Class I or a Class II Type A1 Biosafety Cabinet. Limited chemical manipulation is only allowed in vented Type A2 and Type Cabinets.
11. Activity in a room housing a biosafety cabinet should be kept to a minimum. Activity may cause disruptive air currents in the room and inside the cabinet, and opening/closing doors to the room may change the pressure inside the room.
12. Segregate sterile and contaminated items on opposite sides of the BSC.
13. Work in a BSC from the clean side to the contaminated side.
14. Collect pipets in a red bag within the BSC. Do not use vertical pipette canisters placed on the floor outside of the cabinet.
15. Waste bags shall be placed in the rear of the cabinet and not taped onto the front of the cabinet.
16. No materials should be removed from the cabinet without first being decontaminated with a 70% alcohol solution or being placed in a clean receptacle. Following removal of all materials from the cabinet, the working surface should be decontaminated with the 70% alcohol solution.
17. Following completion of work, the cabinet should be allowed to purge itself for about for two to three minutes before turning off.

18. Some Biological Safety Cabinets come equipped with UV lights. Turn off UV light when the room is occupied. UV exposure can burn corneas and cause skin cancer.
19. All contaminated waste shall be disposed of in accordance with Procedure #103, Regulated Medical Waste.

### **Miscellaneous Precautions:**

1. At no time shall eating or drinking be allowed in facilities where experiments involving biohazardous/potentially infectious materials are being conducted.
2. Proper personal hygiene practices shall be used after handling Biohazardous/Potentially Infectious Materials. Hands should be washed following handling of such material.
3. Non-disposable personal protective equipment shall not leave the work area. Home laundering of lab coats is prohibited. Any disposable personal protective equipment shall be disposed of as waste.
4. Should there be a lapse of time between the generation and pick-up of waste, refrigeration or freezing is recommended for animal carcasses, tissues, organs, and other waste.
5. Any questions regarding biosafety cabinets, biohazardous/ potentially infectious materials should be directed to the New York University Environmental Health and Safety Department at extension 81450.

### **RELATED POLICIES**

NYU Environmental Health and Safety Policy

### **RELEVANT RESOURCES**

Biosafety in Microbiological and Biomedical Laboratories 5th Edition (December 2009), published by the Center for Disease Control-National Institute of Health (For reference see CDC\_BMBL5)

Primary Containment for Biohazards: Selection, Installation and Use of Biological Safety Cabinets”, 3rd edition, DHHS/CDC/NIH, Sept. 2007